PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

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Applicant's or agent's file reference Hi-bu 040656wo	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/US 03/27701	International filing date *(day/month/year)* 04.09.2003	Priority date *(day/month/year)* 05.09.2002
International Patent Classification (IPC) or both national classification and IPC B01D53/00		
Applicant 3M INNOVATIVE PROPERTIES COMPANY et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 5 sheets.

3. This report contains indications relating to the following items:

I	☒	Basis of the opinion
II	☐	Priority
III	☒	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
IV	☐	Lack of unity of invention
V	☒	Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
VI	☐	Certain documents cited
VII	☐	Certain defects in the international application
VIII	☐	Certain observations on the international application

Date of submission of the demand	Date of completion of this report
30.03.2004	14.12.2004
Name and mailing address of the international preliminary examining authority: European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized Officer Bogaerts, M Telephone No. +31 70 340-2335

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/US 03/27701

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:

Description, Pages

1-14 as originally filed

Claims, Numbers

1-24 received on 18.11.2004 with letter of 18.11.2004

Drawings, Sheets

1/5-5/5 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).

   ☐ the language of publication of the international application (under Rule 48.3(b)).

   ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   ☐ contained in the international application in written form.

   ☐ filed together with the international application in computer readable form.

   ☐ furnished subsequently to this Authority in written form.

   ☐ furnished subsequently to this Authority in computer readable form.

   ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

   ☐ the description, pages:

   ☐ the claims, Nos.:

   ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

   (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

   ☐ the entire international application,

   ☒ claims Nos. 21,23,24

   because:

   ☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (specify):

   ☒ the description, claims or drawings *(indicate particular elements below)* or said claims Nos. 21,23,24 are so unclear that no meaningful opinion could be formed *(specify)*:

   see separate sheet

   ☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

   ☐ no international search report has been established for the said claims Nos.

2. A meaningful international preliminary examination cannot be carried out due to the failure of the nucleotide and/or amino acid sequence listing to comply with the standard provided for in Annex C of the Administrative Instructions:

   ☐ the written form has not been furnished or does not comply with the Standard.

   ☐ the computer readable form has not been furnished or does not comply with the Standard.

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-20,22
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-20,22
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-20,22
	No:	Claims	

2. Citations and explanations

see separate sheet

Re Item III:

Claims 21 and 23 lack clarity in that they define a device in terms of process features. Claim 24 lacks clarity in that the category is not defined. Furthermore it refers to claim 12 where no combustion "device" is mentioned.

Re Item V:

Reference is made to the following documents:
D1: EP-A-0691153
D2: US-A-5080696
D3: FR-A-2586204

Independent claims 1 and 12 are new because none of the available prior art documents disclose all the process steps or device features as claimed. In particular the increase (means for increasing) of the dew point and the subsequent decrease of the temperature are not mentioned.

It is believed that the difference leads to an improved removal of contaminants from the exhaust gas.

None of the available prior art documents give a hint to increase the dew point of the exhaust gases before decreasing the temperature in order to enhance the removal of contaminants.

The application thus meets the requirements of Article 33(1) PCT.

Claims

What is claimed is:

1. A method for reducing the contaminant emissions in an exhaust stream from a combustion device comprising:

a) collecting an exhaust stream emitted by a combustion device through an exhaust channel;

b) reducing the velocity of said exhaust stream;

c) reducing the temperature of said exhaust stream such that a part of the gases in said exhaust stream are condensed into liquid form such that said liquid traps particles and noxious gases from said exhaust stream yielding a liquid extraction stream and a residual exhaust stream; and

d) collecting said extraction stream.

2. The method of claim 1 wherein said reducing the velocity of said exhaust stream comprises separating said exhaust stream into multiple sub flows.

3. The method of claim 1 wherein said reducing the velocity of said exhaust stream comprises directing said exhaust stream into one or more channels having a greater collective cross-sectional area than the cross sectional area of said exhaust channel.

4. The method of claim 1 wherein said reducing the temperature of said exhaust comprises transferring heat from said exhaust stream to a cooling medium.

5. The method of claim 1 further comprising washing said exhaust stream with a liquid washing agent such that said liquid washing agent entraps at least some of the particulates and gases in said exhaust stream to yield a residual washing agent and separating said residual washing agent from said exhaust stream.

6. The method of claim 5 wherein said liquid washing agent has a temperature below the temperature of said exhaust stream at the point said liquid washing agent is applied to said exhaust stream.

7. The method of claim 5 wherein said liquid washing agent is applied by spraying.

8. The method of claim 5 wherein said collected residual washing agent is treated such it is suitable to be treated within a municipal sewage network.

9. The method of claim 5 wherein said extraction stream and said residual washing agent are combined.

10. The method of claim 1 wherein the dew point of said exhaust stream is increased so as to facilitate the condensation of liquid fractions therefrom.

11. The method of claim 10 wherein said dew point of said exhaust stream is increased by introducing water into said exhaust stream.

12. The method of claim 11 wherein said introducing water into said exhaust stream comprises spraying water into said exhaust stream.

13. The method of claim 11 wherein said introducing water into said exhaust stream comprises maintaining a source liquid water within a chamber through which said exhaust stream passes such that water from said source is evaporated into said exhaust stream.

14. The method of claim 11 wherein said introducing water into said exhaust stream comprises injecting water vapor into said exhaust stream.

15. The method of claim 10 wherein said exhaust stream with elevated dew point is cooled so as to cause condensation of at least some of the gases contained therein, thereby trapping particulates and gases from said exhaust stream in an extract stream.

16. A device for reducing the contaminant emissions in an exhaust stream from a combustion device comprising:

a) means for receiving an exhaust stream emitted by a combustion device from an exhaust channel;

b) means for reducing the velocity of said exhaust stream;

c) means for reducing the temperature of said exhaust stream such that a part of the gases in said exhaust stream are condensed into liquid form such that said liquid traps particles and noxious gases from said exhaust stream yielding a liquid extraction stream and a residual gaseous exhaust stream; and

d) means for collecting said extraction stream.

17. The device of claim 16 wherein said means for reducing the velocity of said exhaust stream comprises one or more channels have greater collective cross sectional area than the cross section area of said exhaust channel.

18. The device of claim 16 comprising a first section that comprising a series of dissipating tubes arranged in parallel, wherein one end of each tube is connected to the exit of the tube emitting said combustion gases, and the other end connects to an intermediate tube, which in turn, connects to the second section of the device; and a second section configured as an hollow block traversed by a series of passing tubes and comprising an exit for the not condensed residual gases.

19. The device of claim 18 wherein in said hollow block there is a sump for confining the liquid obtained by condensing said gases.

20. The device of claim 16 wherein said dissipating tubes and said condensing chamber comprise metals.

21. The device of claim 16 wherein said dissipating tubes and said condensing chamber comprise polymeric materials.

22. The device of claim 16 further comprising means for increasing the dew point of said exhaust stream.

23. The device of claim 22 comprising means for introducing liquid water or water vapor into said exhaust stream.

24. The device of claim 23 comprising a liquid sprayer comprising one or a set of metal tubes forming one or more coils having orifices at their free end, through which said liquid is injected within the space wherein said gases enter; the other end of each coil tube connected to a tube carrying liquid to these coils; said tube connected to a liquid reservoir.

25. The device of claim 24 wherein said liquid reservoir collects some of said extraction stream.

26. The device of claim 24 wherein said liquid reservoir has an exit near its upper end permitting exiting the liquid by gravity towards another deposit located besides said liquid reservoir.

27. The device of claim 23 wherein said apparatus further comprises a liquid dosing apparatus comprising a hollow cylinder having at its upper end a liquid entrance; immediately underneath said entrance there is a round orifice permitting entrance of liquid to this hollow cylinder; at the lower end of said hollow cylinder there is a constricting element permitting to adjust the number of droplets entering said space for humidifying the gases.

28. The device of claim 27 wherein said hollow cylinder has a window permitting to visual monitoring of the liquid level and droplets movement.

29. The device of claim 27 wherein underneath said constricting element there is an exit tube for the droplets, conveying them to the space wherein the gases are humidified, and due to their high temperature, the droplets evaporate, thus reducing the temperature of the dew point of the gases within the space.

30. The device of claim 27 wherein in that said liquid entrance is an electric or mechanical valve.